History of Rocketry and Astronautics

Proceedings of the Fortieth History Symposium of
the International Academy of Astronautics

Valencia, Spain, 2006

Marsha Freeman, Volume Editor

Rick W. Sturdevant, Series Editor

AAS History Series, Volume 37

A Supplement to Advances in the Astronautical Sciences

IAA History Symposia, Volume 26

AAS Publications Office
P.O. Box 28130
San Diego, California 92198

Affiliated with the American Association for the Advancement of Science
Member of the International Astronautical Federation

First Printing 2012

ISSN 0730-3564

ISBN 978-0-87703-579-4 (Hard Cover)
ISBN 978-0-87703-580-0 (Soft Cover)

Published for the American Astronautical Society
by Univelt, Incorporated, P.O. Box 28130, San Diego, California 92198
Web Site: http://www.univelt.com

Printed and Bound in the U.S.A.

Chapter 3

Origins of the Ukrainian Space Potential—The 85th Anniversary of V. M. Kovtunenko*

V. F. Prisniakov,† S. S. Kavelin,‡ and V. P. Platonov§

Abstract

This paper analyzes the design and scientific developments in which V. M. Kovtunenko participated, shows his talent as a designer, and his contribution to world achievements in space technology.

Against a background of the general history of the development of space technology in the Soviet Union, facts unknown to a wider public audience about the unique biography of V. M. Kovtunenko, who worked for 30 years in this technical field, are presented. V. M. Kovtunenko is one of the authors, and the lead designer, of the first Soviet combat missiles using high-boiling-temperature components, including intercontinental ballistic missiles (R-12, R-14, R-16). V. M. Kovtunenko is one of the first authors of the conversion of combat missiles for use as space probe vehicles in the Soviet Union, and one of the main founders of the launch vehicle, "Kosmos" (with the use of the R-12). V. M. Kovtunenko was the main designer of numerous space probes of various designations on a

---

* Presented at the Fortieth History Symposium of the International Academy of Astronautics, 2–6 October 2006, Valencia, Spain. Paper IAC-06-E4.1.03.

† Institute of Geotechnical Mechanics, National Academy of Science, Dnipropetrovsk, Ukraine. [**Publisher's note:** Dr. Prisniakov passed away on 28 November 2009.]

‡ Design Bureau "Pivdenne," Dnipropetrovsk, Ukraine.

§ Commentator of the international weekly journal *Mirror*, Kiev, Ukraine.

standardized basis (space platforms), for deep space and near-the-Earth space. V. M. Kovtunenko was a great scientist, and the author of works on the aerodynamics of flying vehicles, and the professor of a large number of scientists and experts in the field of space-rocket technology. V. M. Kovtunenko's work as a director of projects in cooperation with India, France, Sweden, and other countries (on Ariabhata, Bhaskara, JRS), and as the main designer of international "space robots" to Mars, Venus, and Fobos, and Astron, Granate, Vega, et cetera, is described.

Introduction

The history of the life of V. M. Kovtunenko is a history of the development of the Soviet space program, and of Soviet international cooperation. The name of the person who managed to make his way from a super-confidential organization to peaceful cooperation in space with the West, during a time when everything was secret, is well known to experts of space-rocket technology, and in official documents. The paper describes this typical representative of the Soviet intellectual, who left the family of a bookkeeper, to become the main designer of space vehicles for deep- and near-Earth space exploration. The report describes the hard life of a person with a lucid mind, with enormous scientific talent, and the talent of the designer, of personal charm, courage, and principle, who maintained his opinion in the interest of truth, irrespective of the circumstance.

Childhood, Studies, and War

Viacheslav Michaylovich Kovtunenko was born on 31 August 1921 in the city Engels in the Saratov region of Russia. His parents came from Ukraine. His father was a bookkeeper, and his mother did not work, but was the tutor of her children, Viacheslav and Nina. The professional qualities of the bookkeeper—accuracy and proper sequence in all affairs his father imparted to all of the children. The development of these qualities was promoted in the environment of Engels, in which the many German colonists who were living there, were known as great workers and pedants, in the good sense of this word. The life of Viacheslav developed as well as possible. In his childhood, he had many intimate and true friends, with whom he played football, and he played a mandolin in the school string band, through which he had an opportunity and a desire to experience performances of theatre, opera, and ballet. He finished school excellently and entered the Moscow Aviation Institute, as he had dreamed of building planes, and of flying. But the war crossed out all of those plans, when he was 20 years old.

In battles near Moscow, Viacheslav Kovtunenko was severely wounded. He recuperated in the Saratov hospital, and came back home from the war an invalid, at the age of 21. A year later, Viacheslav Kovtunenko became a student in the mechanics and mathematics faculty of Leningrad University, which had been evacuated toward the Volga. At the university, Viacheslav not only received modern knowledge, but also married his fellow student, Eugeny Aleksandrovna, who had gone through the siege of Leningrad. She had been awarded a medal, "For the defense of Leningrad." After finishing university in 1948, the engineer-mechanic, Viacheslav Kovtunenko, was directed to Scientific Research Institute-88, in the department of S. P. Korolev.

From then on, Viacheslav Kovtunenko embarked on a path of struggle for new ideas, new projects, new technologies, and new organizations for development of space-rocket techniques, which, to his misfortune, frequently confronted the contradicting realm of secrecy. As a student of the school of engineering and rocketry, Viacheslav Kovtunenko, worked in the department of S. P. Korolev, engaged in the study of aerodynamics and heat and mass transfer processes, ballistics, durability, and design development. His universality as an engineer can be seen in his further activity, and helped him to unite fundamental science with the practical introduction of various technical ideas.

In Dnipropetrovsk

On 6 July 1951, V. S. Budnik was assigned as the Chief Designer of plant No. 586 (Dnipropetrovsk, Ukraine), which was reoriented to the series production of long-range ballistic missiles, and antiaircraft missiles [8]. Agreeing to this proposal, Budnik decided that in Dnipropetrovsk, activity would not only be serial production, but also the designing of new rockets. Therefore, he composed a list of 25 leading designers from the design bureau (DB) of S. P. Korolev and that of V. P. Glushko. Despite the objections of S. P. Korolev, for the transfer of young designers, all of them moved to Dnipropetrovsk. "I very much would have liked to go in Dnipropetrovsk with V. Budnik's group, but he did not let me go," says V. Kovtunenko. "Only in 1953, having taken advantage of a long business trip of S. Korolev, did I quickly put papers in order, and appeared in Dnipropetrovsk. I was pleasantly surprised by the enthusiasm of the employees of the small DB, and their new ideas. At once I undertook their development. We started with a search of materials, experimented, argued, tested, checked, and rechecked. It was desirable to feel the soul of our rocket (R-12, V. P.), its character, to understand its 'ideology,' as it can now be named" [1]. Subsequently, almost everyone who moved to Dnipropetrovsk became chief designers, and known throughout the world: V. Kovtunenko, I. Ivanov, N. Gerasuta, N. Schniakin, M. Nazarov, L. Nazarova, P. Nikitin, M. Dvinin, and others. The presence of these specialists allowed Budnik to follow the same pattern in his DB, as the Special Design Bureau (SDB) of Korolev.

V. Kovtunenko knew well the main designer of machine-building plant No. 586 (which subsequently became the world famous Yuzhmash). In 1946, V. Budnik still worked in the town of Podlipky, but the main thing he and Kovtunenko had in common, was that both of them were believers.

Figure 3–1: V. M. Kovtunenko with V. S. Budnik in the mid-1950s.

After arrival in Dnipropetrovsk in the autumn 1953, Kovtunenko headed the design department, which consisted of four sectors: design, ballistics and dynamics, loadings and structural strength, and warheads. This department had 25 people in 1954. During its existence, it changed to include independent departments, complexes, and a design office.

From his first steps, the extraordinary talent of the head of a key design department was used to find a reasonable and optimal compromise between the enthusiasm of youth, and the care that comes with experience. Understanding the need for vigilance in the development of the first rocket (P-12), V. Kovtunenko used the earlier-approved construction elements to the maximum, as far as new components of fuel (long storage) allowed. He was concerned with configuration, materials, the system of pressurization, stabilizers, flight controls, and also to use the hardware and industrial equipment already used in the plant to make rockets R-2 and R-5M [6].

V. Kovtunenko and Plant No. 586

On 13 February 1953, the governmental decree was released under the initiative of the military, which was elaborated on by the design department of the plant, "Yuzhmach," for the preliminary design of a medium-range missile, R-12 (8A63), using high-boiling-temperature fuel components [8].

Using their acquired experience, but not stopping when the goal was reached, and without doing any harm to the ongoing series production of the DB, V. Budnik, with a group of young designers led by V. Kovtunenko, elaborated the preliminary design of a new ballistic missile, with a range two times better than Korolev's R-5M, in 1953. It became the beginning of a new trend in the development of missile technology. At the creation of the "first born," V. S. Budnik and V. M. Kovtunenko went, not on the well-trodden ground of V. Brown and S. Korolev, but took their own road. In such cases there are always also "fellow travelers," and also opponents [1]. The opponents were many more than young designers want to have. Viacheslav Michaylovich remarked: "We were young and consequently, probably were afraid of nothing—went straight through. The start of our first rocket, R-12 passed successfully. We were as pleased as children, but S. Korolev warned: 'The first start-up is not start-up yet. That will be farther.'"

The first steps taken by the design school of V. Budnik and V. Kovtunenko differed according by their own handwriting, and was characterized by the originality of thought of the designer. In 1954, the independent DB headed by V. Budnik was organized under the SDB headed by M. Yangel, and V. Budnik became his chief deputy. V. Kovtunenko had no special problems in connection with this change of his immediate superior: he had known M. Yangel well, in the DB of S. Korolev.

V. Kovtunenko and Special Design Bureau (SDB) -586

Inspired by their first success, the designers under the management of V. Kovtunenko developed projects for two new strategic rockets, within a short time: R-14 with a range twice that of the R-12 (4,500 km—"for Europe, Asia and Northern America"), and the R-16 intercontinental ballistic missile (ICBM). Under the rather intense pressure of the work, designer Viacheslav Michaylovich encouraged initiatives for studies of new directions in the development of rocket techniques, which could seem premature, or even risky, at first sight. At the same time, many of these ideas were embodied in further developments, such as the EDB-586, and other Design Bureaus of the rocket branch. A generous gift of the designer V. Kovtunenko was the promotion of the creation of unique combat missiles and space complexes. These included second-generation strategic rockets, as a modernization of rockets R-12, R-14, R-16, and also a class of heavy intercontinental rockets, R-36, in ballistic and orbital variants. The production process created in Dnipropetrovsk, which was not only the most advanced in the Soviet Union, but also in the world, allowed N. Khrushchev to state to the world a little bit later, that Dnipropetrovsk produces rockets "like sausages."

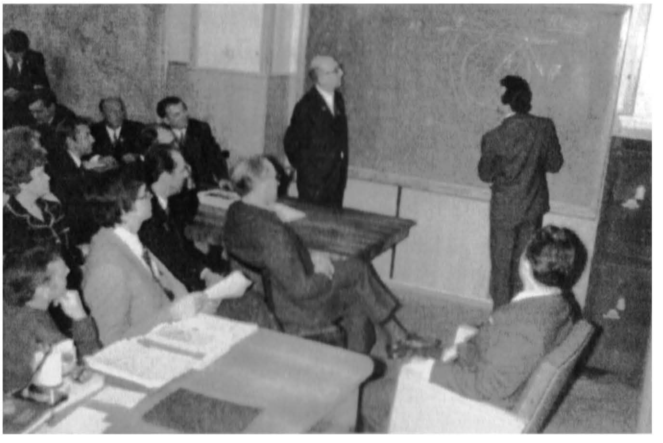

Figure 3–2: Discussion of the design in DB-3 SDB-586.

Figure 3–3: Before the next meeting (1975).

Viacheslav Michaylovich was the first who suggested, and brought to practical realization, the use of combat missiles as the first stage of carrier rockets (CR), for space vehicles (SV). Such rockets became CR "Kosmos," with the first stage of the R-12, and space rocket–carriers, 63C1, 64C2, 65C4, 66C4, 66C5, serially produced, also using the first stages of combat missiles.

In the late 1950s and early 1960s, under the management of V. M. Kovtunenko, work on the super-heavy space rocket, PK-100, was carried out, with a launch mass of 1,200 tons, which was the precursor of the more developed rocket, R-56. The CR R-56 was capable of creating globally connected systems, manned flights to the Moon, the launch of heavy space vehicles to the planets Mars and Venus, et cetera [6].

Unfortunately, the work on this rocket was stopped after the release of the outline sketch for its development, but not for technical or economic reasons. At the same time that the design department of V. Kovtunenko was working out the variants of rockets R-15 and R-21 to equip submarines, the small-sized intercontinental rockets of the class R-37 and R-38 were being researched. The design department of V. Kovtunenko was expanded, along with numerical growth at SDB-586. Seven independent departments were allocated from the design department, having reached the critical number for the optimum control of work. Computational-theoretical complexes were formed, and in all "branch" divisions, the creative beginning, which was born from the intelligent and generous soul of the first head—Viacheslav Michaylovich Kovtunenko—was maintained. Therefore, if one were to speak about the basic "pillars," on which SDB-586 stood, they were the outstanding manager, M. Yangel, and outstanding designers, V. Budnik and V. Kovtunenko.

V. Kovtunenko and University

The successful resolution of a problem depends on the professionalism of personnel, production, and financing. In such a new, little-known, and secret business as the creation of rockets, the key is the instruction of personnel. For the training of specialists, the means for lower and higher education was opened at the technical school and university levels. In 1952, Joseph Stalin signed the decree for the creation in Dnipropetrovsk State University (DSU), of a physical and technical faculty, in which 10,000 specialists on a world level were prepared. One of the services of V. Budnik and V. Kovtunenko is that they were, in DSU, on the initiative of the lead designers, the teachers in special subjects. And Kovtunenko, himself, read lectures to the students in the branch of rocket design. He participated in the activity of the council for the defense of theses. Professors V. Kovtunenko, N. Gerasuta, M. Duplischev, and N. Schniakin became the chairmen in DSU. V. Kovtunenko differed from all of the other professors at DSU. He considered the university not as a place of additional payment, but as a reserve of personnel for SDB-586. He organized the postgraduate study on aerodynamics, introduced new disciplines for students, and gave lectures to students on a high level. He started to create, at DSU, the experimental base for wide-ranging research in the aerodynamics of rockets and space vehicles. The big plot of land near SDB-586 was transformed into a building area where the Complex Physical and Technical Laboratory (CPPL) of Dnipropetrovsk University was built. The laboratory consisted of two departments—aerodynamics and thermal studies. The department of aerodynamics was completed, housing one of the greatest aerodynamic wind tunnels in the Soviet Union. This department developed into a research laboratory, which is still a leader, up to the present time.

V. Kovtunenko and Space (1958–1964)

An interest in the direction of space exploration arose in SDB-586, even before the historical placing of the first artificial satellite in orbit around Earth (artificial Earth satellite, or AES), on 4 October 1957, because D. Ustinov charged SDB-586 with duplicating the work of S. Korolev. But the designers did not see any particular prospects in this task, as the one-stage rocket was not suitable for this purpose. And at that time, there was no special engine for an additional, second stage, in the Soviet Union. After S. Korolev's success in the launching of the first AES, (*Sputnik*), the necessity of "duplicating" his works disappeared, and also interest in SDB-586 had vanished in Moscow. But the "space seed" had been planted in the young romantic minds of design department SDB-586, and they continued to search for ways to work on the problem. By this time, EDB-586, of V. Glushko, had developed engine RD-119, which was suitable for the second stage of a missile. This interested no one, except V. Kovtunenko. In 1958, he suggested a return to the idea of creating, using the base of the R-12, a two-stage space booster (SB).

After the launch of the first AES, the interest of potential customers in a payload grew very quickly. They already posed the question of a transition from launching unique, separate experiments into space, to large-scale space research. Taking into account these circumstances, the designers who were creating strategic weapons, were constantly pushing the main designer, M. Yangel, toward the idea of engaging in space. V. Budnik, N. Gerasuta, and Yu. Smetanin supported V. Kovtunenko. Their desire was enhanced with the confidence that a combat missile is practically already a space booster. Yangel did not object, but he looked at the problem more deeply. On the one hand, the SDB had the main state task of the defense of the country. And, on the other, was the question of whether by absorbing space projects, the DB of S. Korolev had lost its job for the strengthening of the country's defense. Here, there should be a wiser decision, he counseled. Yangel argued, "Each rocket, as well as any machine, must be replaced by a new, more perfect 'product.' Each rocket has a warranty period for storage. What could be made with the rockets which have served their term, and are left 'in storage?' Should they be melted into metal, to be destroyed? On this, we acted earlier than the Americans did" [1].

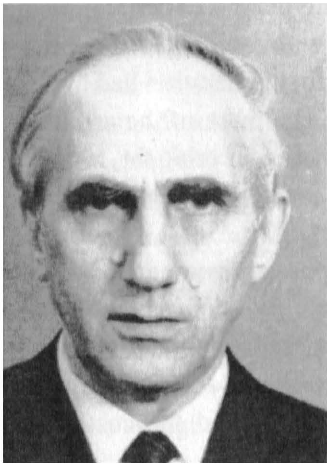

Figure 3–4: Yu. Smetanin

Figure 3–5: N. Zarikov.

Large-scale research of the atmosphere started in the 1960s in the Soviet Union, and was the consequence of surpassing the needed development of combat missiles for strategic purposes. On that basis, the first space boosters opened up the prospects for creating space vehicles for various duties [7, 9]. By this time, many academic institutes of the Soviet Union had prepared scientific plans for carrying out experiments and applied research in space. This was broader than the military-political conditions in the world, which had demanded the creation of space vehicles for military purposes [9]. And SDB-586 appeared in the position of world leader, able to use its available capabilities for the development of space vehicles (SV). The strategy of Yangel was that each combat missile should end up as a space booster.

Studies of the opportunity to create a space booster for an AES began in 1957, and lasted about two years. On 10 December 1959, the decision of government entrusted SDB-586 to officially present concepts for the launch of AES with the help of the R-12 rocket. An outline sketch for SB 63C1 was developed by April 1960. The decision of the government of the Soviet Union to create 63C1, and develop and launch 10 small AES, came on 3 August 1960. Flight tests of the carrier 63C1 in October 1961 and in January 1962 with AES DS-1 No. 1 and No. 2, cannot be called completely successful as to placing these first satellites into orbit, although the reasons for this were not significant (for example, in one of the launches, the tanks were not completely filled with fuel). On 16 March 1962, the successful launch of the first AES series, "Kosmos," with satellite DS-2, was carried out. The first satellite of a series "DS" (which was deciphered informally as "Dniper satellite," in the open, "Kosmos-1"), was assembled in a semi-basement room, because the plant was not yet ready to manufacture space vehicles. Rocket R-12 (8K63), with a second stage, became space carrier 63C1 ("Kosmos-1"). Satellites of the first generation had a pressurized body, with payload inside, and outside devices. The mass of the satellites equaled 300 kg. The design specification was for operation in orbit for 10–60 days. Satellite DS-2, with the name "Kosmos-1," had a mass of 47 kg, and became the model for a huge quantity of space vehicles (more than 2,000), which are still launched under this name. Relative simplicity, cheapness in comparison with the rocket, R-7, convenience of operation, and the reliability of "Kosmos" (the second space carrier in the Soviet Union), allowed the mass launching of space vehicles to be carried out, to enable large-scale space research, and to study the influence of space on Earth. Kovtunenko intensively researched the customer requirements for the space carrier.

After the successful launchings of SDB-586, the stream of demands for the creation of space vehicles for various purposes rushed in from institutes of the Academy of Science of the Soviet Union, and the Ministry of Defense. At a certain point, it became clear that the first period of enthusiasm from familiarization with space ended, and it was necessary to improve the approach to designing space vehicles, which, in many respects, had been unorganized, and instinctive.

First, in 1963, in EDB-586, space complex No. 8 had been organized under the direction of V. Kovtunenko. Second, the problem of meeting deadlines by developing and organizing the manufacture of plenty of SVs of various types, had to be faced by V. Kovtunenko. He understood, that the traditional way of solving this problem was impossible. Essentially, the new and non-standard approach was the acceptance of a principle of the mating of a platform with a space vehicle. This required, for example, the independence of the complex providing onboard systems, of the structure of the vehicle, and of the control circuit by the onboard equipment, from the special feature of the scientific task (using the uniform body, with various standardized systems, such as power, management, et cetera). The essence of the idea is simple [7, 9]: it is to divide the satellite into two parts—a base part (the unified, or standardized part, or platform), and a variable part (the useful payload). The platform remains constant for a wide range of target tasks, which are the variable components—the useful payload. Such an ingenious design decision, for that time, which became conventional and is dominant today in world practice, enabled the organization of batch production of satellites, reducing the time of development and manufacturing, which lowered their cost. Certainly, to have a universal platform for all possible types of useful payloads is impossible. But to group them under one type of platform, is possible. It is obvious, that the transition from one type of platform to another, as a rule, should demand minimal changes.

For the first decade of space research, three types of unified platforms (DS-U1, 2, and 3), were developed. They allowed the launching of more than 125 SVs, including about 40 scientific satellites. DS-U1 was non-oriented, with chemical sources of electrical current. DS-U2 was non-oriented, with solar batteries. DS-U3 was oriented, with solar batteries. The mass of the platform was 265/230/285 kg, respectively, which allowed the placement of useful payloads of 50/60/40 kg of mass to operate for 15–30/40–90/60–75 days [7]. The unified platforms of the first generation were used for launching 44 satellites over 12 years. If not, through a sequence in events, for the pressure and authority of Kovtunenko, the world would have lagged in space research for some years. Really, in science, there is no straight pathway.

Professor Kovtunenko started to plan the creation of the country's Dniper space center, having collected under his wing the best staff of the DBS. Nobody doubted that he would realize it. He had a mass of new ideas, an unusual organizing ability, and indisputable prestige for his scientific work and brilliant practice. He prepared many first-class experts . . . Everything was developing very positively, but . . . Yangel saw in it, the attempt to infringe on the supreme interests of the defense of the country [1].

Fatal Defeat for Ukraine of V. Budnik and V. Kovtunenko (1962, 1967)

At the first meeting of the Academy of Science of Ukraine, immediately after obtaining independence, academician V. S. Budnik warned about the possibility of Ukraine losing its main space-rocket area of activity, DBYu and Yugmach, which were able "to solve the most severe and complex problems," able "to play an essential role in the development of the national economy of Ukraine, and to strengthen its prestige as a state" [10]. Unfortunately, a decision could not be made, because Ukraine had already lost its main direction, which was world missilery, which had been returned to Russia. And its outcome was the defeat of V. Budnik and V. Kovtunenko, going back to 1962. How so? By the beginning of the 1960s, SDBYu had elaborated the basics of using the rocket, R-14, as a space booster, and 65C3, for the orbital injection of large satellites. Simultaneously, in DB-3 DBYu, under the management of V. M. Kovtunenko, research was conducted on the creation of three artificial satellites of Earth (two communications satellites, and one meteorological), for the new booster [11]. Yangel feared (from our point of view, groundlessly), that he could not manage this problem because of the overload of work at DBYu and the manufacturing plant. And "M. K. Yangel decided, at this time, to transfer all available backlog for boosters and satellites to other organizations, for a second time"* [11]. It was strange. DBYu was coping with these problems. The most difficult first elaborations were executed. As this took place, such fear was absent, even in view of the outlook of the amount of work for DBYu and Yugmach. And when the time came to receive the bookings, and "to cut the coupons," the fear appeared "managed." Most likely, the limitations of the country's financial assets, and the struggle for the orders was already beginning to show itself. In the beginning there was a game "of democracy." Yangel sought internal council about the question of the forthcoming changes in the transfer of projects. But here, he met opposition from missile authorities, Budnik and Kovtunenko: "What are you doing, Michail Kuzmich! The communication and meteorology satellites are like veins of gold, you understand all that perfectly well! There will be so many of them. It is work not only for DB, but also for other plants, for a lifetime! Weather and communication services are for always, and they will be necessary permanently in all time" [11].

Legendary Yuzhmash director A. M. Makarov (1961–1986) spoke [14]: "Vyacheslav Mihajlovich it was proven to all: it is impossible to let go, for next to nothing, the creation of communication satellites and of weather satellites on the side. It is a business for all life. He was right; one thousand times right" [1]. But "while I am the chief," said Yangel, he decides everything, and transmits decisions to M. Reshetnev in Krasnoyarsk, and to A. G. Iosifyan in Moscow, thereby throwing out the game of "democracy," and despite the opposition of the specialists in his council. The opposition of Budnik and Kovtunenko were prophetic, as their proposed direction did become really "golden," and the means of subsistence for many world organizations.† And then, after the loss of the need of booster production in Ukraine,‡ it was very clear that activity in space communi-

---

* The first time was the generous and baseless transfer of marine subjects to V. P. Makeev in Miass. Baseless, because in 20 years DBYu was compelled to return to marine missiles.

† In October 1967 the big group of experts (about 100 people) of DBYu-3 was transferred from rocket projects, the number of divisions DBYu-3 was reduced, and the "Yantar" class was handed over to CSDB (Samara) [9].

‡ Usage of "Zenith" in the program Sea Launch plays most likely symbolical, rather than a main role in realization of capabilities of Ukraine as a space state.

cations, in monitoring weather, and in remote sensing of Earth, which Budnik and Kovtunenko fought for 30 years earlier, were useful now for Ukraine! But all the same, Ukraine had not lost all. The firmness and dedication of Kovtunenko had an incomplete result, but laid the basis for the revival of space subjects in DBYu.

V. Kovtunenko and Space—New Boundaries in DBYu-3 (1965–1971)

Naturally, Vyacheslav Mihajlovich experienced this turn of events very painfully, but he did not lose strength of mind, or his unrestrained energy, directed toward the realization of new ideas. The space vehicles that were created made a huge contribution, not only to the development of space, but also to the defense of the Soviet Union. Reconnaissance satellites allowed the detection of a probable attack and warned of a nuclear threat. Therefore, after the transfer to other DBs of some space vehicle projects, the opportunity arose to concentrate on the development SVs for military purposes.

Despite the merits of the development of military rocket technology that had been developed, Kovtunenko was transferred in 1963 to DBYu space design complex No. 8, which he organized. This complex was transformed into a DB of space vehicles, DBYu-3, on 30 October 1965. Due to the persistence of Kovtunenko, specialized space manufacture was created at Yuzhmash, where the production of SVs was put "on stream" for the first time in the Soviet Union. Under the management of Kovtunenko, types of satellites, in an absolutely new direction for military projects, were developed, including space vehicles for survey, and detailed radio engineering ("Zelina-O"—1964–1970, 1972, "Zelina-D"—1965–1976, and "Meteor"—1964–1970). With the availability of more powerful rocket-carriers, such as "Cyclone-3," in DBYu, under the direction of V. Kovtunenko, a number of families of new unified platforms such as "AUOS," "Typhoon," "HXM"—(six satellites), with both Earth- and Sun-orientation were developed. On the basis of these platforms, 15 unique scientific satellites (including satellites under the international cooperation program, "Interkosmos"), were developed and put into orbit.

Opportunities for newly created platforms in DBYu-3 grew considerably. So, for example, in comparison with the first platform, DS-U, the automatic, unified orbital station (AUOS-3, 1971), allowed the placement of a useful payload with ten times the mass, providing a five times larger power supply, able to handle some tens of times higher volume of transmitted data [7, 9]. The period from 1965–1971 was one of the most fruitful in the history of DBYu-3 [7, 9]. Over seven years, 14 projects were developed, and 108 satellites of 28 types were launched and operated in orbit. In 1971, DBYu was the world champion with the quantity of 24 satellites injected into orbit.

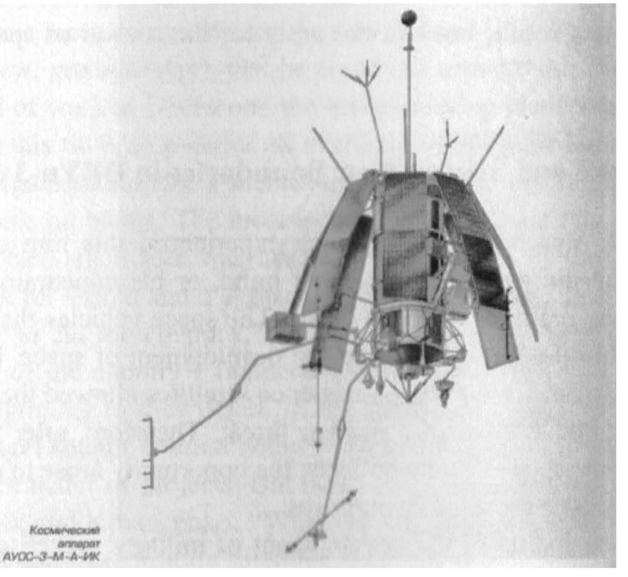

Figure 3–6: Space vehicle AUOS-3.

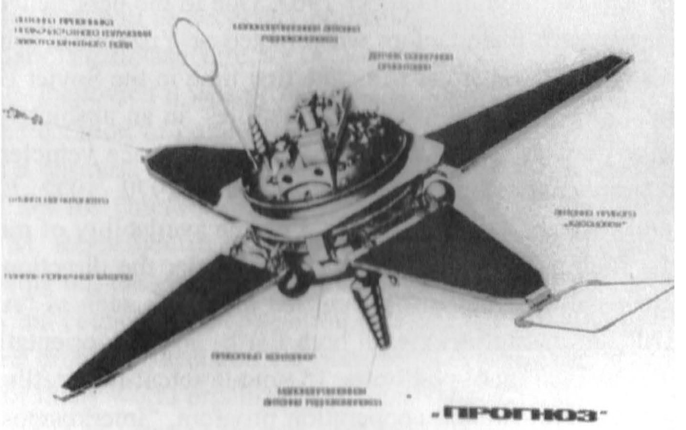

Figure 3–7: Space vehicle "Prognoz."

In 1971, V. Kovtunenko organized in DBYu-3, broad cooperation in the creation of a global television system of observation (the television global scout-TGS). We shall say more in detail about this work, because it is characteristic of Vyacheslav Michaylovich's activity in the creation of space infrastructure in Ukraine. The TGS system was designed to monitor everything that threatened the safety of the country. A powerful power plant should be in orbit to support the satellite, for a long time, with a mass of a few tons. Such a plant should be nuclear, and the engine, which keeps the TGS in its orbit, should be electric rocket propulsion (ERP). Forty years ago, numerous circuit ERP system ideas were known.

Two of the greatest challenges were the creation of the ERP, and research into the processes of a nuclear power plant (NPP), with turbo-machine conversion (except for a fast reactor). These tasks were charged to the chair of rocket engine development at Dnipropetrovsk State University (DSU), the manager Professor V. Prisniakov. Most of the challenge was to use, both in the ERP and in the NPP, liquid alkaline metals—potassium, sodium, and lithium. For this work, the Complex Physical and Technical Laboratory (CPPL), was constructed, with participation from, and through the initiative of, V. Kovtunenko. For 20 years, under the management of Prisniakov, the unique experimental facilities for research in the heat and mass transfer processes in a NPP and of the characteristics of the ERP were used.

Other, not less complex tasks, were transferred to the Harkiv Aviation Institute, and its Physical and Technical Institute. In scientific laboratory DSU, over 100 employees were working. Tens of laboratory employees defended their dissertations as candidates for a Doctor of Science degree.* Over a period of 20 years, practically all types of ERP were developed and tested. At the 56th Congress of the IAF in Japan, foreign organizations presented many reports on the ERP, actually repeating the results obtained at DSU. Many of them were far from our level.

Most of the program of space research in circum-terrestrial space was executed since 1960 with the help of automatic SVs and the space boosters from DBYu-3 and Yuzhmach. This research included the following directions, formulated in many respects by V. Kovtunenko, himself.

1. Research of the galaxy [7, 9]:
    - study of the fundamental basis of micro- and macrocosm structure
    - study of space electromagnetic radiation, including remnant radiation
    - revealing the existence of antimatter
    - checking the theory of relativity
    - studying meteoric streams and meteoric substance
    - studying stars and nebula.

* In 1998, academician Prisniakov was discharged from his duties by bureaucrats of the "scientific mafia," and without any basis, was deprived of his management position, and as chair of the scientific laboratory, which he had created. Now, the laboratory created through the initiative of V. Kovtunenko is practically destroyed, and the chair is divided.

2. Research of the Sun:
   - its seismology and internal structure
   - dynamic processes on the Sun as a basis for forecasting
   - processes the transport of energy from the "bowels" of the Sun
   - solar corpuscular radiation and its influence on the magnetosphere of Earth
   - the interrelation of sunlight and ecology.
3. Research of Earth and circum-terrestrial space, in particular:
   - the radiation belts of Earth and general radiation conditions
   - the magnetic field
   - the atmosphere
   - the radiation balance of Earth, and meteorological processes
   - the systems of the oceans and atmosphere, and how they help determine weather and climate
   - the ionosphere, magnetosphere, circum-terrestrial plasma
   - distribution of radio waves
   - search for new natural resources of Earth.

Since 1979, DBYu-3 has actively joined in the realization of applied space programs in the interest of the national economy, and in ecological monitoring with the use of its own space vehicles. The following tasks were accomplished:

- An estimation and forecast of the condition of agricultural crops, pastures, woods, soils, reservoirs, and snow cover
- Tracking ice cover in polar regions with a view toward the maintenance of navigation
- The forecast and control of the development of cyclones and hurricanes
- Long-term weather and climate forecast
- Mapping geological structures for the purpose of revealing minerals
- The control of the bioefficiency of the ocean and continental shelf, detection of zones for fishing craft
- The control of pollution of regions and territories
- The gathering of information from dangerous and remote areas.

In the last years of V. Kovtunenko's work in DBYu, research on the creation of space system "Ocean" was started, within the framework of the program of space research of natural resources, which was under his management.

Figure 3–8: "Ocean-O" before sending from the cosmodrome.

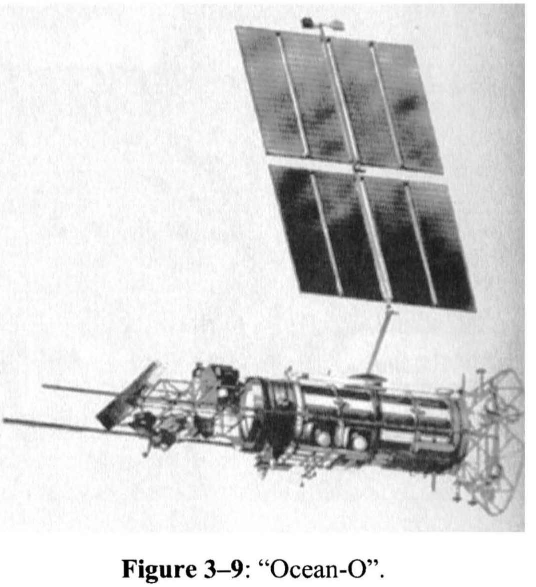

Figure 3–9: "Ocean-O".

V. Kovtunenko's pupils have continued this undertaking, by the development and operation of satellites "Ocean-01" (1989–1993), and "Ocean-OЭ" (1983–1986), for maintaining information on ice conditions in polar regions, "Ocean-about" (1999), for studying world (global) ocean and land, with optical and microwave observations, and "Ocean-Ø" (1979–1982), for taking soundings of the surface of the ocean from space. V. Kovtunenko's ideas did not come to an end even after his death, as evidenced by the development of the first satellite of an independent Ukraine, "Sich-1" (1995), and "Sich-1M" (2004).

Figure 3–10: V. M. Kovtunenko with V. Kukuchkin.

Figure 3–11: V. M. Kovtunenko with N. F. Gerasuta.

V. Kovtunenko and International Cooperation

Being engaged in space research of Earth, the Sun, and the galaxy, V. Kovtunenko understood this is not a problem for one DB, or one country. It is a problem for all of mankind, which demands global study of the phenomena and complex methods of research. V. Kovtunenko was one of the first to understand, that it is necessary, in this regard, to concentrate the efforts of scientific research from all countries. Space should not separate, but unite people. The Academy of Science (AS), came to that conclusion, and provided input to the decision of the government of the Soviet Union, "About cooperation of the USSR and the socialist countries in the field of research and the use of space for peaceful purposes," on 15 April 1965. Its implementation was assigned to the AS of the Soviet Union and the ministries. In 1967, Interkosmos was created to advise on international cooperation. Its chairman was academician B. Petrov, and the general director for international programs of "Interkosmos" was Professor V. Kovtunenko. The government of the Soviet Union had stipulated the production and launching of six satellites on the basis of the modification of DS-U1, DS-U2, and DS-U3. The satellites were intended for research of shortwave radiation of the Sun and solar activity, corpuscular radiation in circum-terrestrial space, and the ionosphere of Earth. The scientific equipment was produced by countries which were participants in joint projects.

Figure 3–12: V. M. Kovtunenko with B. Petrov and S. Mandelchtam (1970).

Figure 3–13: V. M. Kovtunenko with V. Utkin, V. Keldich, V. Kotelnikov.

Figure 3–14: Session of council Interkosmos.

On 14 October 1969, at the Kapustin Yar cosmodrome, the space booster "Kosmos-1" (11K63), put into orbit the device DS-U3-IK-1 in the presence of foreign scientists from nine countries. It received the official name, "Interkosmos-1." Under this program, 25 more "Interkosmos" craft were launched, of which 22 were developed by DBYu-3. Among the space partners were France (series SV "Oreol" under project "Arkad"—1971, 1973, 1981); Sweden; and India, satellites "Ariabhata" (1975), "Bhaskara-1" (1979), and "Bhaskara-2" (1981). It is necessary to say, that international cooperation with a secret organization in a closed city was not very easy. All contacts with foreign scientists passed "under the roof" of the Academy of Sciences, or Dnipropetrovsk University. Any trip abroad had to be sanctioned, and was under the control of the special services. V. Kovtunenko's outstanding merit was that he was the first to make a hole in the Iron Curtain, and the first to have raised the question of the globalization of space research, and to see its realization.

V. Kovtunenko and Lavochkin Research and Production Association

In December 1977, V. Kovtunenko was appointed the main designer of Lavochkin Research and Production Association (NPO) (Moscow). A new stage of his creative activity began. The transfer of Vyacheslav Michaylovich from DBYu, where he was the main designer, to a world-renowned NPO, gave him a sense of hope to be able to use his inherent, natural ability to combine the systems approach with a large-scale consideration of problems, in order to realize the purposes with which he was supplied. The government hoped that with this transfer, V. Kovtunenko would find ways and opportunities "to pull out" the talented collective at Lavochkin NPO from its most difficult situation; actually from an impasse. Something similar was required in the decision on the further use of "space robots," to make them appealing, not only to scientists and theorists, but also to politicians and state military strategists. The absence of such an understanding, and a mistake in the choice of orientation, appeared as "a weak part" in the activity at Lavochkin NPO after the death of its main designer G. N. Babakin. The new main designer, V. Kovtunenko, was met with a guarded look at the NPO.

However, his great natural gift of analytical thinking, and his ability to foresee the consequences of planned actions in advance, helped him find adherents. He not only directed the activity of the collective of 12,000 people optimally, but he was also able to build partnerships with tens of different types of companion organizations, and incorporate them into cooperation in the development and realization of the next space project.

V. Kovtunenko applied and introduced the concept of the "SV as the unique research tool," essentially changing the basis of mutual relations among scientific and nonproduction experts, and in every possible way, strengthening their creative joint work in all development cycles. It was not so simple to fight for the realization of his own projects and ideas, which occurred constantly (here again, V. Kovtunenko was the recognized fighter), and what is more, for the decisive battle for the formation of a long-term program of research of deep- and near-space, with the help of international space stations. And again, due to the efforts of V. Kovtunenko, one of the most closed enterprises of the Soviet Union opened its doors to the scientific world for broad international cooperation. Practically all subsequent projects of Lavochkin NPO received international status [1].

The correctness of the approach of V. Kovtunenko was confirmed with the success of astronautics research of the planets, of the solar system, and near-Earth space [6]. Space vehicles "Venus," "Mars," "Astron," "Fobos," "Interbol," "Forecast," "Granat," "US-K," and a lot of others were created under his management, over his 18 years at Lavochkin NPO. These missions confidently added to human knowledge, with new openings in fields of nature and the laws of existence of the universe. This supported and strengthened the scientific authority of the Soviet Union.

One of the bright events in the world of science was the project "Venus—Comet Halley," ("VEGA"). It was truly an innovative step in space research—the approach of an unmanned probe with a "wandering" heavenly body. The comet's mechanics of movement was practically unknown at the moment the expedition was sent. The success of this extremely difficult program was due to V. Kovtunenko's joint efforts with the director of the Institute for Systems Research (ISR), R. Sagdeev [6].

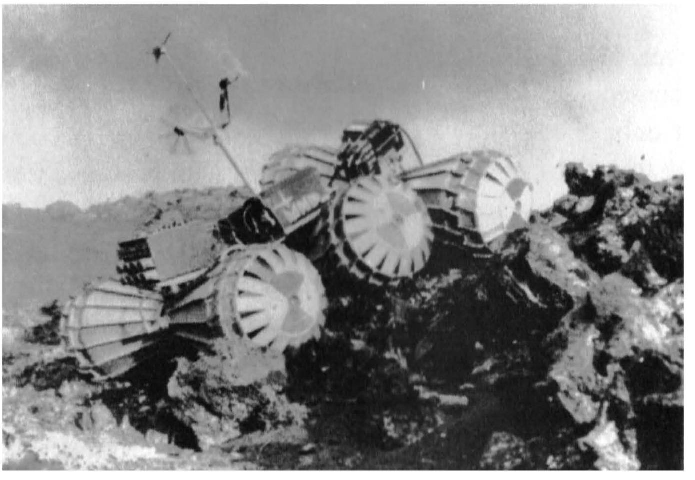

Figure 3–15: Mars rover.

Figure 3–16: V. M. Kovtunenko with R. Sagdeev.

Figure 3–17: V. M. Kovtunenko with V. F. Utkin.

V. Kovtunenko and Science

From the moment of his appointment to a key post in SDB-586, as the head of a design department, V. M. Kovtunenko made one of the priorities of the organization the maintenance of the scientific development of rockets first, and then space vehicles. The circle of scientific interests of the professor in aerohydromechanics included, first of all, theoretical development and applied research, regarding the aerodynamic analysis of long-range missiles, gas dynamics calculations of rocket silo installations, and the definition of aerodynamic characteristics and temperature modes of rockets through flight tests. Under the initiative of V. Kovtunenko, and with his participation, studies were carried out on the theory of calculation of the flow around rotating bodies of a supersonic stream of gas, supersonic gas jet development at non-calculable modes of discharge, aerodynamic characteristics of simple bodies in a free molecular stream, the theory of systems of pressurization, et cetera. His personal scientific developments received wide practical application. He created his own scientific school in the field of designing the multipurpose unified satellite platform, a rational combination of passive and active methods of temperature control of SVs, practical realization of the idea of the construction of economical systems of orientation with the support of the gravitational field of Earth, in combination with the application of precision astrotelevision means of definition of the orientation of the SV, research in the dynamics of elastic systems, the choice of optimum parameters and means of power supply systems, et cetera.

V. Kovtunenko played an outstanding role in the propagation and wide introduction of space technology as a unique tool in the solution of fundamental scientific problems, the establishment of the effective and fruitful interaction of space science with universities and academic institutions. V. Kovtunenko was the first to solve the problem of the form of axially symmetric bodies of minimal resistance at supersonic speeds. His work was secret for a long time and only in 1970, was it unsealed and published in the open literature. V. Kovtunenko actively participated in developing engineering methods of the calculation of the aerohydrodynamical characteristics of flying vehicles, the hydrodynamics of bodies penetrating into water, the aerohydromechanics of hypersonic currents, non-stationary aerodynamics, industrial aerodynamics, and many other areas.

V. Kovtunenko—The Individual Personality

The authors of this paper knew Vyacheslav Mihajlovich very well. We were meeting with him about the solution of many problems constantly, with the chief, and with the partners in teamwork, or with outstanding scientists. All of us note his light mind, intelligence, and literacy (school of Leningrad University). The general director of NPO Yuzhmash, Alexander Maksimovich Makarov, who knew V. Kovtunenko for 25 years through team work, said about him: "Always, V. Kovtunenko stood out: elegantly dressed—a snow-white shirt, a proper tie, perfectly ironed trousers—an example of the classical professor. It was not pleasant for many, who would appear for work in dirty boots, in a rumpled shirt. He had a reputation as 'our person' who is a 'blue blood,' and even a 'gentleman,' or 'baron.' Never was V. Kovtunenko 'the baron' He was the great worker. The thinker. Look, the missile that was designed in his department is better than that of S. Korolev."

It is necessary to say that the authority that Vyacheslav Mihajlovich had in the Soviet Union was as great as that among scientists in the international scientific community. His name opened all doors beyond borders, and V. Kovtunenko is respected still today.

Destiny presented V. Kovtunenko with the opportunity to work among those who are named the pioneers of astronautics. He was the trailblazer: he offered his own road to space, and created a unique planet. Life is continuing. In the infinite expanse of the universe, in the constellations of the big and small stars, there is one more bright star—V. Kovtunenko's planet is shining.

Figure 3–17: Followers of V. M. Kovtunenko in DB-3:
S. Kavelin, V. Dranovskiy, A. Olchevskiy, A. Popel (1997).

Figure 3–18: V. M. Kovtunenko with M. Gorbachev.

Chronology of the Life of Viacheslav Michaylovich Kovtunenko

31 August 1921 – born in the city of Engels

1941 – Red Army man of 914 shooting shelf, participated in the fight near Moscow, wounded

1942–1948 – student of mechanics-mathematical, faculty of the Leningrad University

1948–1953 – engineer, calculating man, the head of group of department S. P. Korolev, Scientific Research Institute-88, Podlipki

1952 – defense of the master's thesis

1953–1963 – chief of design department SDB-586

1963–1965 – chief of a space complex No. 8 SDB-586

1965–1977 – main designer DB of space vehicles (DB-3 of SDB-586)

1977–1995 – General Designer Lavochkin NPO

10 July 1995 – death.

Figure 3–20: Viacheslav Michaylovich Kovtunenko (31 August 1921—10 July 1995).

References

[1] V. P. Platonov, "Planet of Kovtunenko V." *Zerkalo nedeli* No. 541 (9 April 2005).

[2] V. Prisniakov, "V. S. Budnik Is the Person Who Laid the Groundwork of Design Bureau 'Yujnoe,'" paper IAC-03-IAA.2.1.05 in *History of Rocketry and Astronautics*, Proceedings of the Thirty-Seventh History Symposium of the International Academy of Astronautics (held in conjunction with the 54th International Astronautical Congress, 29 September – 3 October 2003, Bremen, Germany), O. G. Liepack, editor, Volume 34, AAS History Series (San Diego: Univelt, Inc., 2011), pp. 501–522.

[3] V. S. Budnik, *From Attack Aeroplane IL-2 Up to Space Rockets. Memory* (Dnipropetrovsk: DSU, 1993). 44 pages.

[4] V. Prisniakov, E. Abramovsky, S. Kavelin, "Viacheslav Kovtunenko—His Life and His Place in the History of Astronautics," paper IAC-97-IAA.2.1.04 in *History of Rocketry and Astronautics*, Proceedings of the Thirty-First History Symposium of the International Academy of Astronautics (held in conjunction with the 48th International Astronautical Congress, 6–10 October 1997, Torino, Italy), D. C. Elder and G. S. James, editors, Volume 26, AAS History Series (San Diego: Univelt, Inc., 2005), pp. 37–40.

[5] V. Prisniakov, V. Gorbulin, I. Statsenko, S. Lyaguchin, and S. Konyukhov, "Orbital Scientific–Technological Complex," paper IAF-93-R.3.444 (paper presented at the 44th International Astronautical Congress, 16–22 October 1993, Graz, Austria) Abstract, p. 117.

[6] S. S. Kavelin, "Viacheslav Michaylovich Kovtunenko: The Scientist, the Creator, the Enthusiast," *Space-inform* No. 13 (153) (30 March–5 April 2004): pp. 36–39.

[7] A. Maschenko, V. Pappo-Koristin, V. Paschenko, and V. Vasiliev, editors. *Raketu I kosmicheskie apparatu. DBYu* (Dnipropetrovsk: Yuangel Yuzhnoeя, 2000), 240 pages.

[8] V. Pappo-Koristin, V. Platonov, V. Paschenko, *Dneprovskiy Spacerocket Center. Short Handwriting of Becoming and Development. DAZYuMZ-DBYu: The Chronicle of Dates and Events* (YuMZ-DBYu, 1994), 180 pages.

[9] Konstruktorskoe buro kosmicheskix apparatov, komplexsov I sistem KB-3. Ruk. avt. kol. S. Kavelin (Dnipropetrovsk: Yuangel Yuzhnoeя, 2003), 300 pages.

[10] V. S. Budnik, "About a Team Working with M. K. Yangel," Speech on general meeting of department of mechanics AS USSR, 23 October 1991.

[11] L. V. Andreev, S. N. Konuhov, "M. K. Yangel—Chief Designer of Space-Rocket Systems," *Space Science and Technology* Vol. 2, No. 2 (1996): 64 pages.

[12] V. F. Prisniakov, I. N. Stasenko, V. I. Dranovsky et al. "Universal Orbital of Solar Power Satellite," Paper IAF-95-R.2.08 (paper presented at the 46th International Astronautical Congress, 2–6 October 1995, Oslo, Norway).

[13] V. F. Prisniakov, I. N. Stasenko S. F. Lyaguchin, V. I. Dranovsky et al. "Space Vehicle Power Supply from Power Satellite: Demonstration Experiment," Poitier, France, 1995.

[14] V. P. Platonov, "Makarov: The Art–Documentary Biography," *Prospect* (Dnipropetrovsk, 2006).